



MAISON FIBRE: THE FUTURE OF BUILDING

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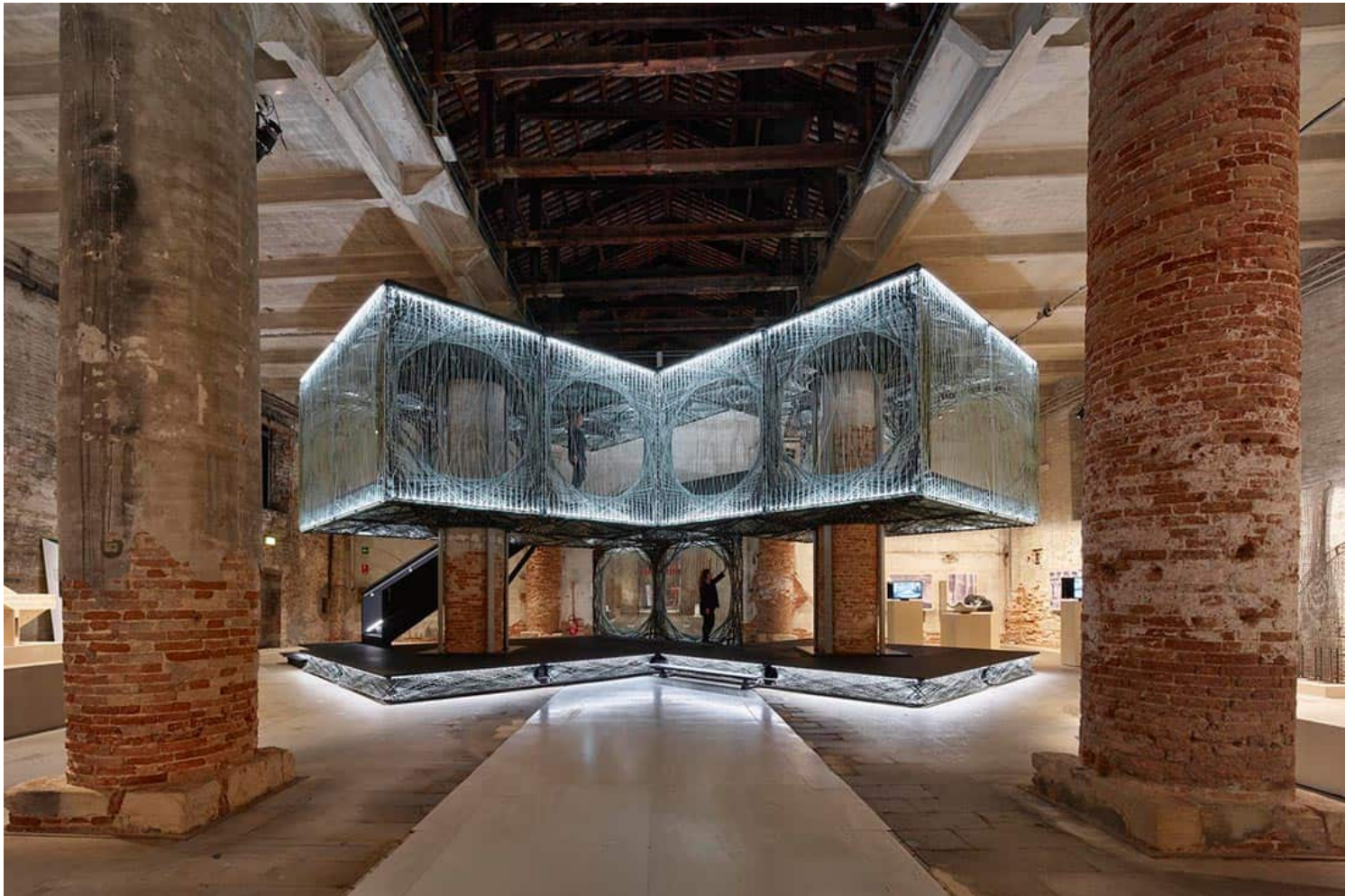
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We spend 87% of our lives in buildings. Buildings constitute the physical substrate for living together, and it is precisely this materiality and materialization of buildings that poses one of the most important ecological and social challenges to society. The question of how people will live together in the future is thus intrinsically linked to the question of the future of building.



Construction has become one of the most materially intense and environmentally detrimental human activities. The per capita consumption of construction materials for loadbearing structures alone, which account for more than half of the materials used in buildings, has multiplied over the last century. Building in the present form, which prioritizes simple construction processes over

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saving material and resources, no longer seems sustainable. New approaches are urgently needed.

Nature provides just such a paradigmatic alternative. Almost all load-bearing structures in biology are fibrous systems, in which the fiber organization, directionality, and density are finely calibrated with the occurring forces. The resulting high level of morphological differentiation, functionality, and related resource efficiency are emblematic of natural structures. The biomimetic principles of using "less material" by having "more form" have been investigated for many years by the project team at the University of Stuttgart. Fibrous construction offers a profoundly different material approach for building future human habitats.

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Maison Fibre: Towards a Material Culture of Dematerialization

ICD and ITKE's contribution to the Biennale Architettura 2021 is an exploration of an alternative material culture, a term commonly used in the social sciences and the humanities. Maison Fibre, the central display of the exhibition, is both a full-scale architectural installation and an open model for the cultural change being postulated. It deals with the departure from pre-digital, material-intensive construction using mostly heavy, isotropic building materials such as concrete, stone, and steel – which are often extracted in faraway places, processed into building elements, and then transported over long distances – and the shift toward genuinely digital construction methods with locally differentiated and locally manufactured structures made of highly anisotropic materials: an

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architecture made of fibers.



Maison Fibre is based on a decade of research on robotically manufactured fiber composite structures. It is the first multi-story architecture of this kind, featuring inhabitable fibrous floor slabs and walls. The entire structure consists exclusively of so-called fiber rovings: essentially bundles of endless, unidirectional fibers. To underline the model character of the project, a system of reconfigurable wall and ceiling elements was developed based on the 2.5-meter grid dimension typical of residential buildings.

The project's projective aspect is derived from its reference to a formative model of architectural history: Le Corbusier's Maison Dom-Ino. The floor area of the installation corresponds to the

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historical reference, as does the division over three floors and the versatile, expandable system. The radically different nature of fibrous construction – compared to the tectonics of massive building elements – can be experienced spatially and tactilely by visitors. Another key difference is the possible adaptability and thus the interaction with the existing building stock, which will be decisive for future urban buildings. This is deliberately emphasized by integrating the existing columns of the Arsenale building into the installation.

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Fibrous Tectonics: Adaptable Materialization and Variable Materiality

The fibrous wall and ceiling elements were manufactured using the coreless, robotic winding process developed by the project team, which allows for locally load-adapted design and alignment of the fibers, thus enabling an extraordinary lightweight construction. The code-compliant, loadbearing fiber structure of the upper floor weighs just 9.9 kg/m^2 . The wall elements are even lighter.

For the fabrication of a loadbearing floor element, less than 2% of the component volume is required as material volume. This extremely low material consumption coupled with the very compact

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robotic production unit could in the future make it possible to carry out the entire production on site without a significant amount of noise or waste, not only during the initial construction process but also during expansion or conversions. As a result, architecture built using this method will remain adaptable and flexible in the long term.



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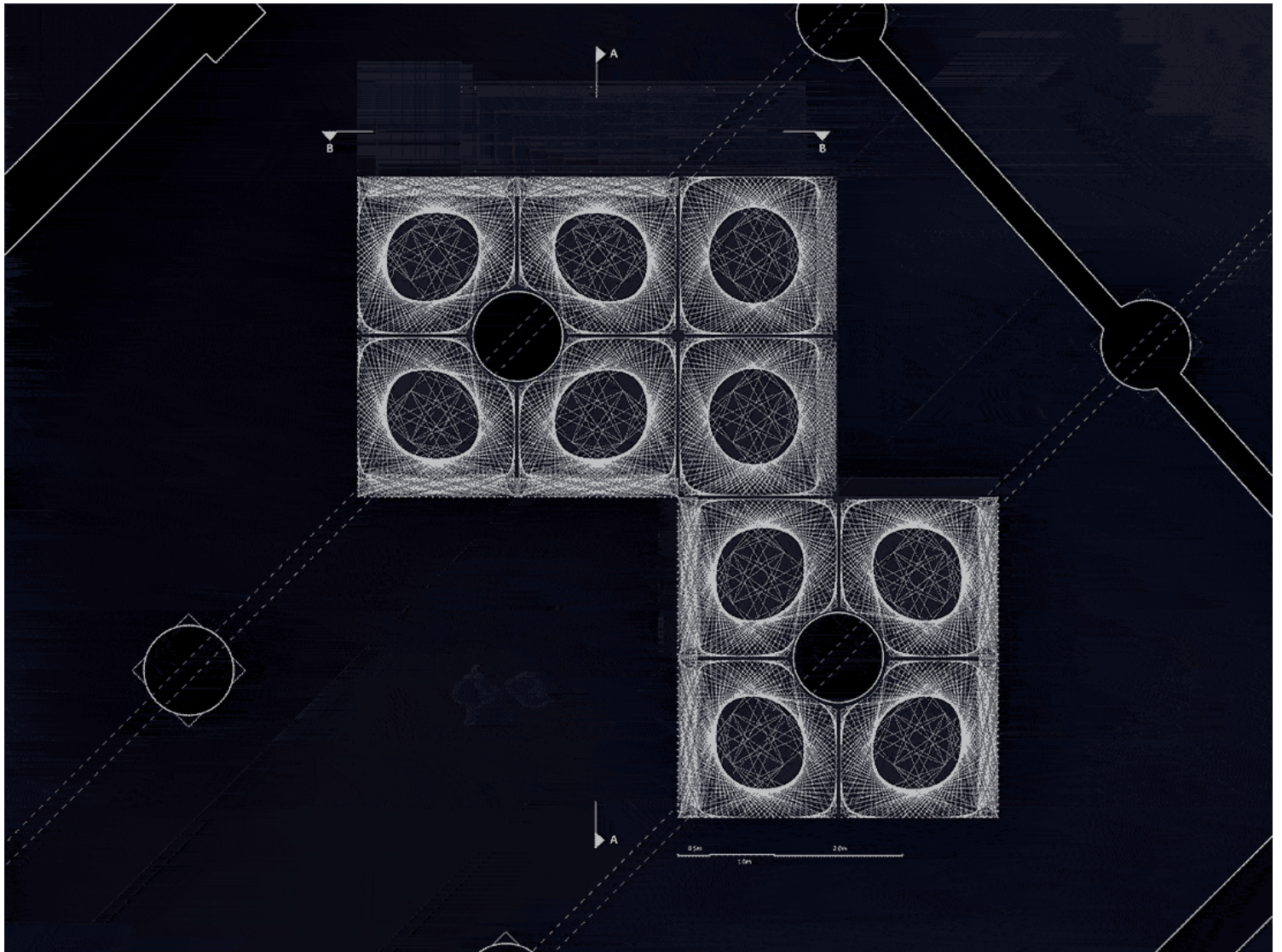
The building methods investigated in this project can be used for a variety of materials. While Maison Fibre still largely makes use of the currently available glass and carbon fiber systems, there are already signs of a considerable expansion of the material spectrum in the near future, ranging from mineral fiber systems that can withstand extreme temperature stresses to natural fiber systems that grow within an annual cycle. These approaches to the materialization and materiality of architecture, which differ significantly from established notions of building, are explained to visitors in the exhibition sections "Materialization Perspective" and "Materiality Perspective" housed on the upper floor of Maison Fibre.

Maison Fibre itself shows the spatial expression and authentic architecture of a highly

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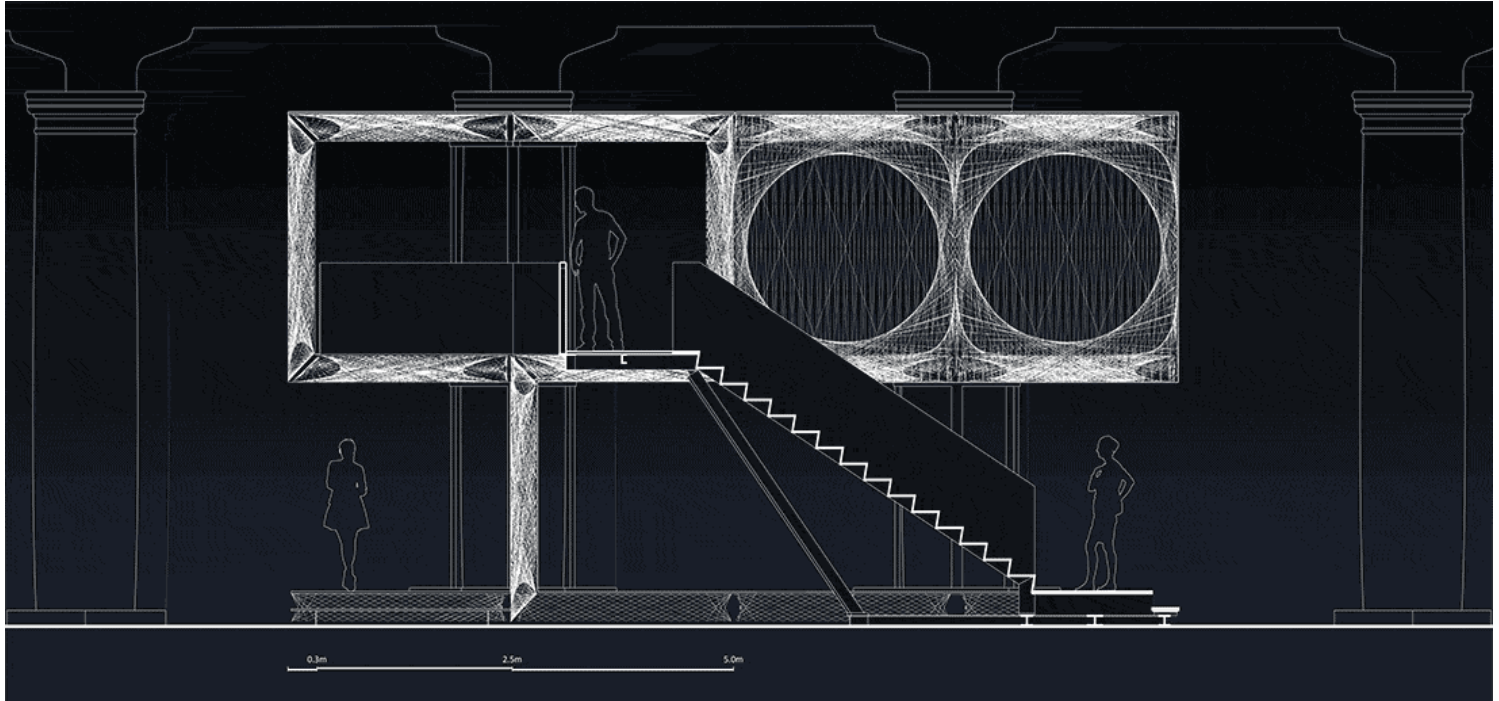
dematerialized structure, in which the reconfigurable building elements are made from just a few kilos of construction material. Compared to Le Corbusier's Maison Dom-Ino as a role model for 20th-century architecture, the weight footprint of the structure is reduced fiftyfold and points toward a novel material culture in architecture as well as the larger ecological (material and energy), economic (value chains and knowledge production), technical (digital technologies and robotics), and sociocultural matters entailed therein.



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